Yeathouse Quarry, Cumbria

[NY 041 170]–[NY 043 168]

Introduction

The Yeathouse Quarry GCR site, near the village of Frizington, 7 km east of Whitehaven, includes the small quarry at Yeathouse [NY 041 170], the entrance cutting to the original quarry complex, and exposures along the course of the old mineral railway to the south-east [NY 043 168]. The exposed succession includes a significant unconformity between the Dinantian and Lower Palaeozoic rocks, parts of the Seventh. Limestone and a fairly complete section from the top of the Sixth Shale to the base of the White Limestone. While this last section is attributed entirely to the Asbian Stage (e.g. George *et al.,* 1976; Mitchell, 1978), there is disagreement concerning the presence or absence of strata attributable to early Asbian times, as discussed in the Introduction' to this chapter. Although many sources (Barclay *et al.,* 1994; Akhurst *et ed.,* 1997) indicate that early Asbian strata are absent in west Cumbria (Figure 4.2), the description that follows is based on the detailed sedimentological work of Thurlow (1996) who, following earlier biostratigraphical work by Strank (1981), regarded the section from the top of the Sixth Shale to the base of the White Limestone as belonging to the early Asbian sequence. A significant early description of the succession was provided by Eastwood *et al.* (1931) and further biostratigraphical information has been given by Welsh (1980).

Description

At the south-east end of the site, on the northeast side of the old railway on the slope down to Windergill Beck [NY 045 166], the unconformity between the Dinantian succession and the Skiddaw Group is exposed (Figure 4.14). The unconformity was revealed by a scrape in 1991–1992, organized by the Groundwork Trust at the request of the Cumberland Geological Society. Just over a metre of coarse pebbly sandstones were seen to rest on cleaved Skiddaw Group deposits. These Carboniferous deposits lie within the Basement Beds of Eastwood *et al.* (1931) and were referred elsewhere to the Pu Zone by Welsh (1980).

Between the unconformity and the entrance cutting to Yeathouse Quarry, parts of the Holkerian Seventh Limestone (= the Frizington Limestone Formation of Barclay *et al.,* 1994) containing *Lithostrotion* can be seen. Directly overlying the Basement Beds are coarse sucrosic dolomites and sandy packstones with hummocky cross-stratification (N. Riley, pers. comm., 2002) interbedded with a few homogeneous grey carbonate mudstones. Above this, thin beds of cross-stratified fine-grained sandstone appear. To the north-west of the site of Yeathouse Station, 7 m of cherry, argillaceous limestones occur, interbedded with fine sandstones and siltstones. These are presumed to lie high up within the Seventh Limestone.

The most recent sedimentological work on the Asbian successions of north and west Cumbria is that of Thurlow (1996) and the descriptions and interpretations that follow are based on his logs (see (Figure 4.15)). The Sixth Limestone and the Fifth Shale (now partly obscured by vegetation) are seen in the quarry entrance cutting [NY 042 169]. The top of the Sixth Shale is a clay with carbonate concretions. About 11 m of Sixth Limestone are seen with the lower part of the succession containing cross-stratified crinoidal grainstones. In the middle part, coarse, brown-coloured dolomite occurs and the upper part of the succession consists of two units of bioclastic wackestone and packstone with a diverse fauna including *Siphonodendron, Syringopora, Caninia, Palaeosmilia,* crinoids, brachiopods, bivalves and gastropods, separated by a thin palaeosol clay. Strank (1981) recorded a foraminiferal fauna from the Sixth Limestone at Yeathouse which she regarded as comparable with that of the Potts Beck Limestone in the early Asbian type section (see Little Asby Scar GCR site report, Chapter 5).

The Fifth Shale, also known as the 'Chonetes Shale', is 9 in thick at Yeathouse and consists of two terrigenous clastic units separated by a unit of crinoidal wackestone and packstone. The lower terrigenous clastic unit is a dark-grey to black shale with thin horizons crowded with chonetoids, productoids and productoid spines. The upper unit comprises interbedded mudstones and very fine sandstones. Mudstones are bioturbated by *Planolites* and are rich in plant debris; sandstones are calcite-cemented and have gutter casts on their bases, hummocky cross-stratification within and rippled

tops. The Fifth Shale at Yeathouse is the type horizon for the trilobite *Linguaphillipsia cumbriensis,* described by Riley (1984).

The Fifth Limestone at this site is 16 m thick. The base is seen at the mouth of the cutting leading into the quarry, where it is rather sandy. In the quarry face, highly fossiliferous, somewhat bituminous limestones pass upward into paler-coloured, coarser, grainy limestones. The fauna includes corals (*Siphonodendron, Lithostrotion, Syringopora, Palaeosmilia, Dibunophyllum*), crinoid fragments, brachiopods, bivalves and gastropods. *Thalassinoides* burrows are prominent in the lower part of the limestone. The succession is punctuated by a thin grey-green palaeosol clay. Terrigenous clastic beds attributed to the Fourth Shale occur In the southwestern corner of the quarry, but are not easily accessible. They comprise mostly vari-coloured (grey-green and purple) silty mudrocks and fine silty sandstones. The White Limestone rests with a sharp contact on these beds. Only the lowest beds are seen and they comprise pale-coloured crinoidal packstones and grainstones.

Interpretation

According to Akhurst *et al.* (1997), the thin basal red-bed succession consists of locally derived Lower Palaeozoic material deposited on a coastal alluvial plain and in fluvial channels. The Seventh Limestone at this site is poorly exposed and partly dolomitized, making it difficult to determine depositional environments in detail, but it most probably represents the deposits of a storm-influenced shallow sea which gradually became established across the Lake District Block.

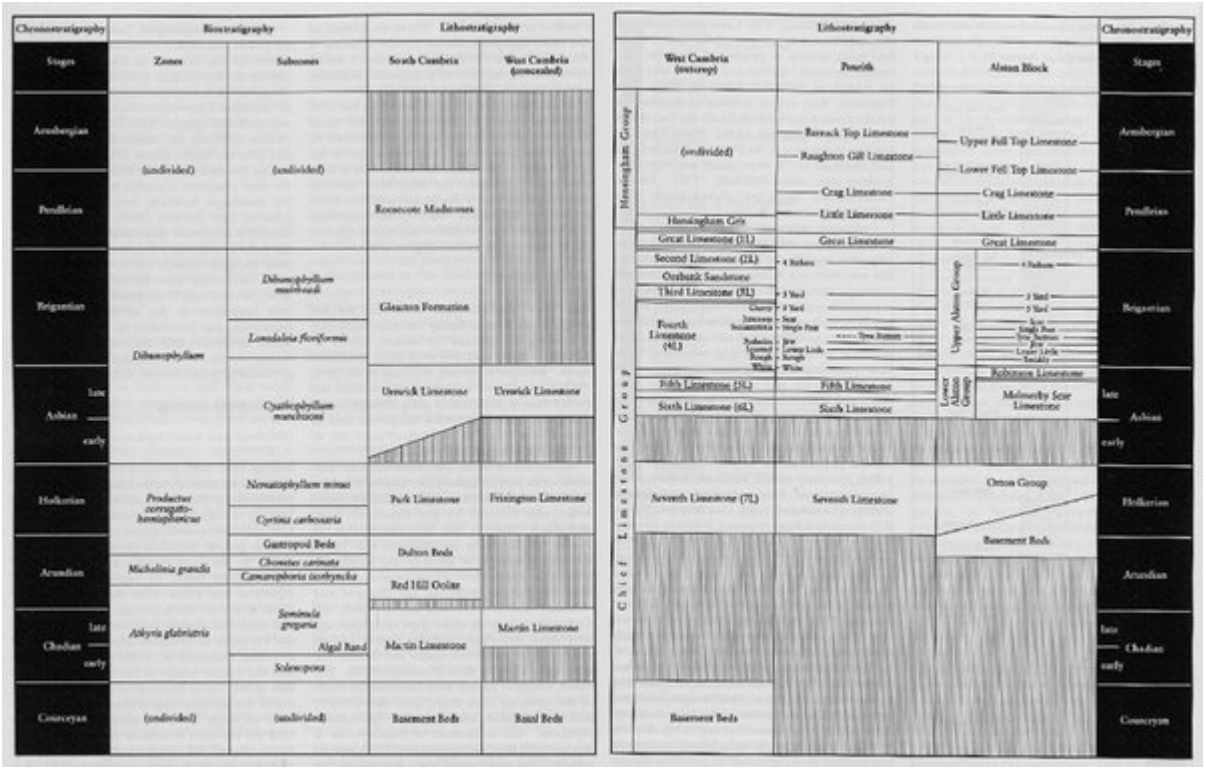
Cyclicity is a feature of Asbian shelf sequences everywhere in Britain. Those of the Asbian succession in west Cumbria are rather more complex than many elsewhere as a result of the significant terrigenous clastic input. Thurlow (1996) recognized six cycles in the 'early' Asbian sequence of west Cumbria, with cycles 2–6 present at Yeathouse, cycles 2–5 in the Sixth Limestone, and the Fifth Shale comprising cycle 6. Each cycle broadly records upward shallow-ing, sometimes with evidence for subaerial exposure at the top. The beginning of the following cycle shows evidence of deepening compared with the upper part of the preceding cycle, although a transgressive unit may be present. For example, cycle 6, the Fifth Shale, begins with shales deposited in an offshore, variably anoxic environment. This is followed successively by subtidal carbonates that show some evidence of shallowing, by clastic deposits of a shallow storm-dominated shelf, and by lower shoreface sandstones (Thurlow, 1996). The occurrence of coarse dolomite in the middle of the Sixth Limestone may be related to local faulting (Thurlow, 1996).

The Fifth Limestone and Fourth Shale make up two shallowing-upward cycles, the first consisting entirely of limestone capped by a palaeosol clay and the second consisting of limestone capped by the alluvial deposits that make up the Fourth Shale.

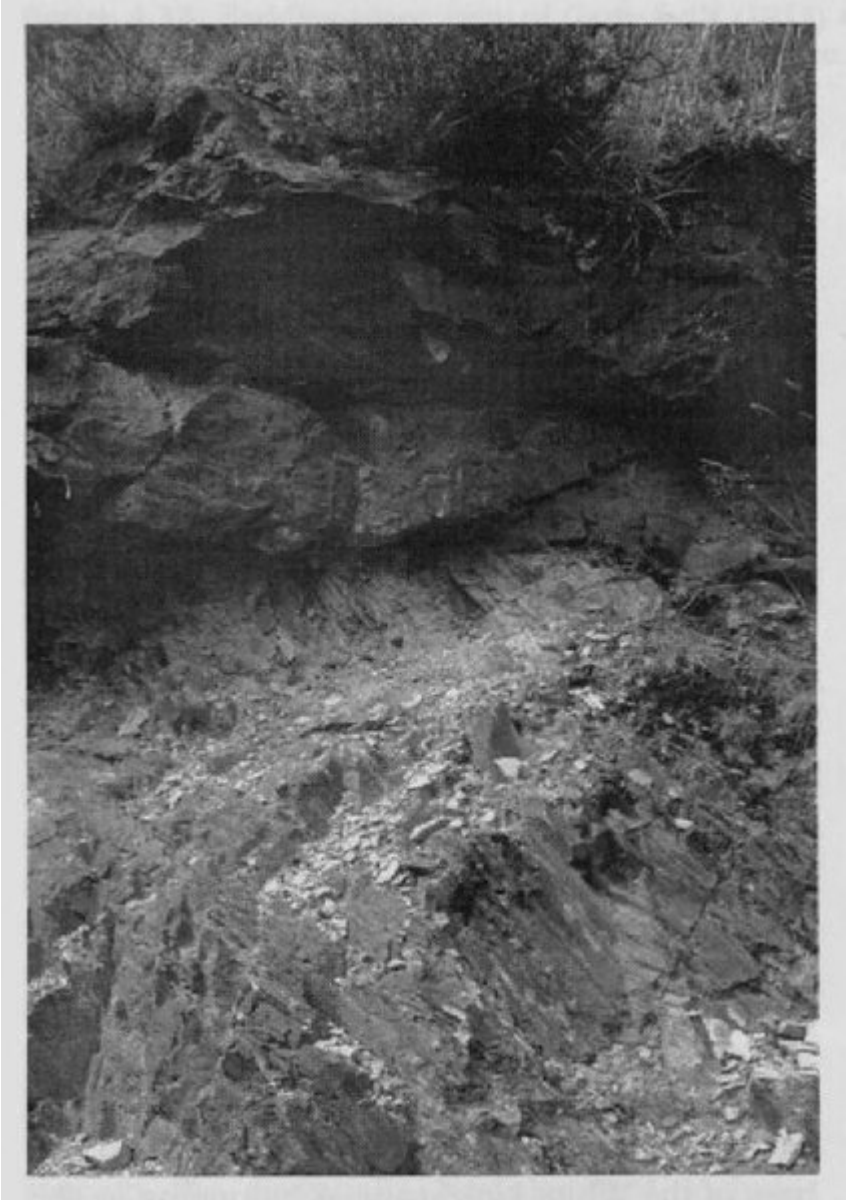
Conclusions

This site is important for showing the unconformity between the Dinantian succession and the Skiddaw Group. It also displays a near-complete section through the disputed early Asbian succession and good exposures of the late Asbian Fifth Limestone. It is particularly valuable for the study of Asbian cycle style in a mixed clastic-carbonate shelf environment.

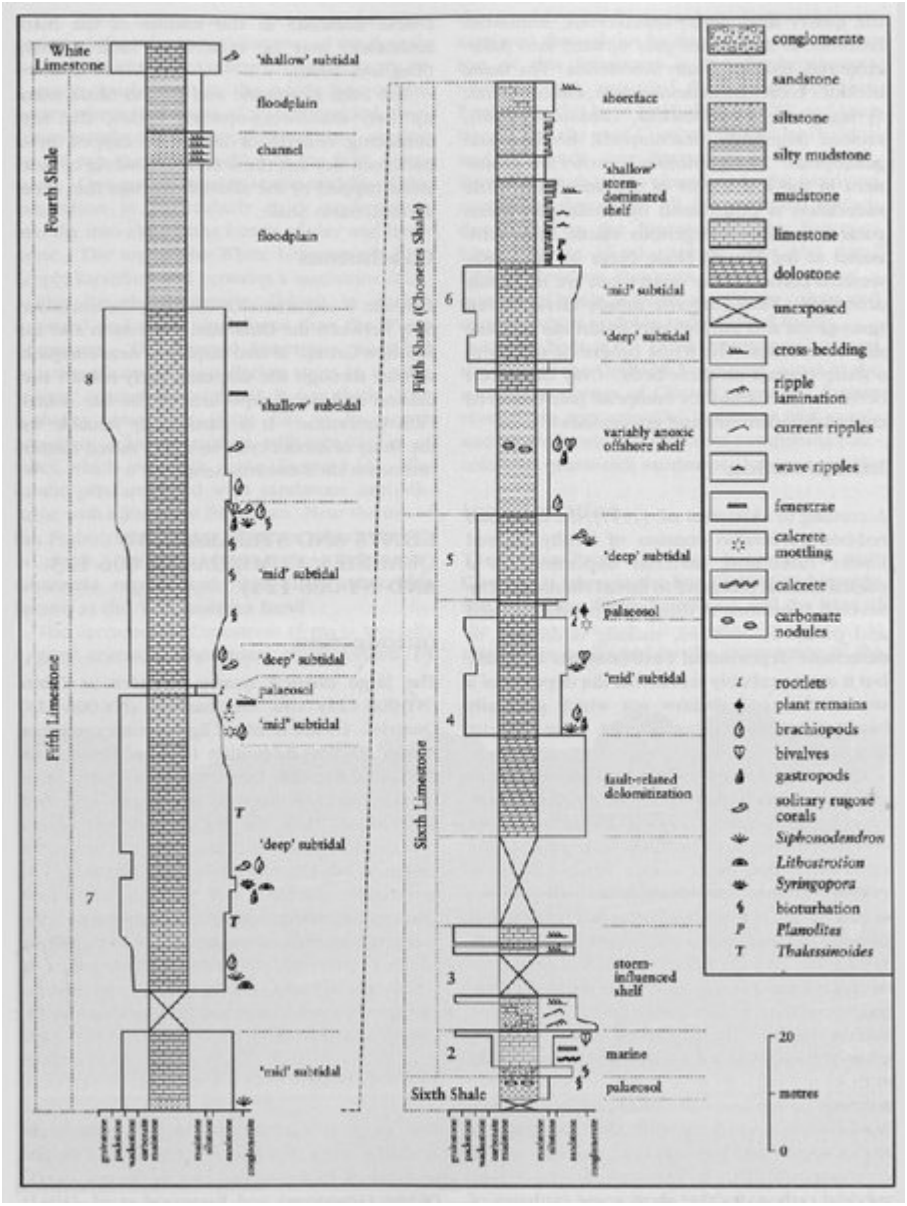
References



(Figure 4.2) Simplified stratigraphical chart for the Lower Carboniferous succession of the Lake District Block and Alston Block; the age of the Basement Beds is uncertain in many areas. Compilation based on information from Eastwood et al. (1931), George et al. (1976), Rose and Dunham (1977), Mitchell (1978), Ramsbottom (1978a), Arthurton and Wadge (1981), Athersuch and Strank (1989), Horbury (1989), Dunham (1990), Barclay et al. (1994), Chadwick et al. (1995) and Akhurst et al. (1997). Zonal biostratigraphy (Chadian–Brigantian only) after Garwood (1913). Areas of vertical ruling indicate non-sequences. Not to scale. Note that following text submission, the majority of those lithostratigraphical units in the 'South Cumbria' and West Cumbria (concealed)' columns have been designated as formations (Johnson et al., 2001).



(Figure 4.14) The unconformity between Lower Carboniferous Basement Beds and the slates of the Silurian Skiddaw Group exposed in the old railway cutting at the Yeathouse Quarry GCR site. Note keys (right of centre) for scale. (Photo: A. Thurlow.)



(Figure 4.15) Simplified sedimentary log of the Chief Limestone Group succession at Yeathouse Quarry from the Sixth Limestone to the White Limestone. After Thurlow (1996). Numerical subdivisions of the succession refer to Thurlow's (1996) notation of sedimentary cycles.